information (SI) specific to each CC are transmitted on the respective CC. From the higher-layer perspective, each CC appears as a separate cell with its own Cell ID.

[0111] In Rel-12 for example, a small cell ON-OFF feature was specified, enabling fast turning ON and turning OFF of a secondary cell (SCell) in CA system. In turned-OFF mode, only a specific discovery reference signal (DRS) is transmitted in a cell with a rather long periodicity, while rest of the time nothing is transmitted in a cell. The DRS enables UEs supporting this feature to make initial discovery of the cell as well as to make initial RRM measurements on a cell.

[0112] It is expected that this new cell On/Off feature will be a key ingredient of CA deployments on unlicensed band. Given that CA deployments in unlicensed band may utilize a large number of CCs (CA with 32 CCs are examined in Extended CA WID in Rel-13), it is expected that only part of CCs are configured and activated (as active SCells) for UEs in a typical network load situation while rest of CC are sleeping (i.e., turned-OFF SCells). Since the turned-OFF SCells are quiet most of the time (not transmitting anything) they can potentially be used as complementary or auxiliary CCs for active SCells, to be used whenever transmission on its associated active SCell is blocked by other systems like Wi-Fi or by other LAA system.

[0113] Therefore, the exemplary embodiments of the invention include that, in unlicensed band, a carrier such a turned off SCell carrier could be configured as an ACC that is linked via RRC signaling or via a SI to one or more active SCells. If some of active SCells is not able to carry the data burst at particular point of time due to fact that the carrier is in use of some other system (e.g. Wi-Fi) or some other LAA operator, then that data burst may be transmitted in ACC assuming that the ACC is free at that moment (should be checked by LBT procedure). In other words, a certain data burst consisting of certain HARQ processes may be transmitted in ACC in the case when the SCell activated to carry those HARQ processes is momentarily blocked by other systems. The data burst carries physical downlink control channels (PDCCHs) and physical downlink shared channels (PDSCHs) where each PDSCH comprise data elements belonging to a specific hybrid automatic repeat request process of a specific UE.

[0114] Concerning synchronization of ACCs, it is safe to assume that active SCell and the associated ACC are always synchronized (at least time synchronization applies) since they are always transmitted by the same eNB. Maybe the fine-tuning of synchronization parameters may need to be done but that can be done by using the reference signals included in the data burst (e.g. using CRS). On the other hand, an ACC may still transmit their own DRS, so that UEs entering unlicensed band can detect them as turned-off SCells (before such UE is configured and activated to any SCell). Based on DRS, all UEs operating of unlicensed band can perform RRM measurements in turned-OFF SCells (i.e. ACCs) and these measurements may be used as criterion to set ACCs associated with a certain SCell in the order of preference.

[0115] In the preferred solution, reconfiguration, addition, and removal of ACCs for each SCell is performed by RRC signaling, e.g. using SCell reconfiguration message and/or changing the content of the SI of the SCell. Thus each ACC belongs to at least one SCell and its addition and removal can be managed via SCell management procedures.

[0116] In one embodiment, a number of ACCs may be assigned to a SCell while some of the other SCells may be configured with no ACC. In that situation, UEs with high aggregation capabilities may be assigned for and scheduled in SCells that have ACCs associated with them, while UEs with low aggregation capabilities are assigned for SCells with no ACCs. Thus the UEs with high aggregation capabilities will experience lower latency on average compared to UEs with low aggregation capability.

[0117] At any point of time, the division of CCs of unlicensed band into SCCs and ACCs, performed by the eNB, may depend on number of UEs to be served in the cell range of SCells, the amount of data in the transmit buffer of the eNB, aggregation capabilities of the UEs etc. The changes in CC configurations may be done by using the reconfiguration procedures of the SCell.

[0118] A rationale behind configuring of turned-OFF SCells as ACCs and linking them to one or more active SCells is that the UE complexity can be reduced in a manageable way. With configured ACCs, the EU needs to monitor only a limited set of CCs for transmission of its HARQ processes. In the example of FIG. **5**, only one ACC is configured for each active SCell and thus the UE needs to monitor only two CCs for potential transmission of its HARQ processes.

[0119] An eNB Operation in the Case That SCell is Configured with at Least One ACC:

[0120] Every time the eNB aims to transmit a data burst consisting of a number of subframes in a SCell, it will perform LBT/CCA on SCC and ACCs simultaneously and, based on the results of (e)CCA measurements and the order of the preference of the CCs, the eNB selects one CC for the transmission of that data burst. For example, if there is only one ACC linked to the SCell, the eNB checks the availability of both SCC and ACC by performing (e)CCA on both CCs and if SCC is available for transmission that is selected and if only ACC is available that is selected. If neither CCs are currently available the eNB continues the polling of both CCs and selects the one which becomes first available.

[0121] When (e)CCA indicates that the channel is available the eNB may transmit a reservation signal on CC until the start of the next subframe. The reservation signal may or may not include useful (PDCCH) data symbols. It may alternatively/additionally include cell-specific ID signature signal, e.g. cell-specific CRS. Note that the reservation signals are marked with the letter 'R' in FIG. **5**.

[0122] The UE Operation in the Case That SCell is Configured With at Least One ACC:

[0123] When a UE has aggregation capability which enables simultaneous detection on all configured SCCs and their respective ACCs, the UE is assumed to try to decode PDCCH on those CCs continuously until a successful decoding of at least the common control signals like physical control format indicator channel (PCFICH) or equivalent or until a successful decoding of PDSCH assignment message targeted for the UE. The successful decoding of at least some part of PDCCH indicates to the UE whether SCC or some of the ACCs is used for transmission of the next data burst. The length of the transmission burst in terms of the number of subframes (1 ms) is assumed to be semi-statically configured or provided by the system information. During transmission of the data burst the PDCCH need to be decoded only on CC that is used to carry the data burst. In accordance with the exemplary embodiments the LTE does not need to monitor or decode PDCCH on the ACCs, at least not regularly since the